In the Claims

Please amend the claims as follows:

A1

1. (Amended) A method for forming an etched silicon layer comprising:

providing a first substrate having formed thereover a first silicon layer;

etching the first silicon layer to form an etched first silicon layer while employing a plasma etch method employing a plasma reactor chamber in conjunction with a plasma etchant gas composition which upon plasma activation provides at least one of an active bromine containing etchant species and an active chlorine containing etchant species, wherein within the plasma etch method:

(1) a cleaned plasma reactor chamber is seasoned to provide a seasoned plasma reactor chamber having a seasoning polymer layer formed therein; wherein the seasoning method is selected from the group consisting of dummy wafer seasoning methods, product wafer in-situ seasoning methods and waferless seasoning methods;

(2) the first silicon layer is etched to form the etched first silicon layer within the seasoned plasma reactor chamber; and

(3) the seasoning polymer layer is cleaned from the seasoned plasma reactor chamber to provide the cleaned plasma reactor chamber after etching the first silicon layer to form the etched first silicon layer within the seasoned plasma reactor chamber[,] prior to etching a second substrate having formed thereover a second silicon layer to form an etched second silicon layer formed over [a] the second

substrate within the plasma reactor chamber while employing the plasma etch method in accord with (1), (2) and (3).

A1 cont

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7. (Amended) A method for forming an etched monocrystalline silicon layer comprising:

A2

providing a first substrate having formed thereover a first monocrystalline silicon layer;

etching the first monocrystalline silicon layer to form an etched first monocrystalline silicon layer while employing a plasma etch method employing a plasma reactor chamber in conjunction with a plasma etchant gas composition which upon plasma activation provides at least one of an active bromine containing etchant species and an active chlorine containing etchant species, wherein within the plasma etch method:

(1) a cleaned plasma reactor chamber is seasoned to provide a seasoned plasma reactor chamber having a seasoning polymer layer formed therein; <u>wherein the seasoning method is selected from the group consisting of dummy wafer seasoning methods, product wafer in-situ seasoning methods and waferless seasoning methods;</u>

(2) the first monocrystalline silicon layer is etched to form the etched first monocrystalline silicon layer within the seasoned plasma reactor chamber; and

(3) the seasoning polymer layer is cleaned from the seasoned plasma reactor chamber to provide the cleaned plasma reactor chamber after etching the first monocrystalline silicon layer to form the etched first monocrystalline silicon layer within the seasoned plasma reactor chamber[,] prior to etching a <u>second substrate</u>

A2 cont

having formed thereover a second monocrystalline silicon layer to form an etched second monocrystalline silicon layer formed over [a] the second substrate within the plasma reactor chamber while employing the plasma etch method in accord with (1), (2) and (3).

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12. (Amended) A method for forming an etched polycrystalline silicon layer comprising:

A3

providing a first substrate having formed thereover a first polycrystalline silicon layer;

etching the first polycrystalline silicon layer to form an etched first polycrystalline silicon layer while employing a plasma etch method employing a plasma reactor chamber in conjunction with a plasma etchant gas composition which upon plasma activation provides an active bromine containing etchant species, wherein within the plasma etch method:

(1) a cleaned plasma reactor chamber is seasoned to provide a seasoned plasma reactor chamber having a seasoning polymer layer formed therein; wherein the seasoning method is selected from the group consisting of dummy wafer seasoning methods, product wafer in-situ seasoning methods and waferless seasoning methods;

(2) the first polycrystalline silicon layer is etched to form the etched first polycrystalline silicon layer within the seasoned plasma reactor chamber; and

(3) the seasoning polymer layer is cleaned from the seasoned plasma reactor chamber to provide the cleaned plasma reactor chamber after etching the first polycrystalline silicon layer to form the etched first polycrystalline silicon layer

A3 cont

within the seasoned plasma reactor chamber[,] prior to etching a second substrate having formed thereover a second polycrystalline silicon layer to form an etched second polycrystalline silicon layer formed over [a] the second substrate within the plasma reactor chamber while employing the plasma etch method in accord with (1), (2) and (3).

Please cancel claims 6, 11 and 16 as their limitations have been incorporated into amended independent claims 1, 7 and 12, respectively.

Please add claims 17 to 34:

A4

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-- 17. The method of claim 1, wherein the dummy wafer seasoning methods include a method selected from the group consisting of:

i) a silicon oxide coated dummy wafer method;

ii) a silicon oxide coated dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas; and

iii) a silicon dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas.

18. The method of claim 1, wherein the dummy wafer seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 1 to 500 mTorr;

a source radio frequency power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature and a dummy wafer temperature of from about 20 to 200°C;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

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an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

A4 Cont

19. The method of claim 1, wherein the product wafer in-situ seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature and a product substrate temperature of from about 20 to 200°C;

a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

Sub B4

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

20. The method of claim 1, wherein the waferless seasoning methods, when using an eight inch diameter substrate, employ:

A4 Cont

a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature of from about 20 to 200°C;

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a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

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a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

21. The method of claim 1, wherein the first silicon layer etch step, when using an eight inch diameter substrate, employs:

a reactor chamber pressure of from about 1 to 500 mTorr;

a radio frequency source power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz and an external bias power of up to about 500 watts;

Sub B4

a substrate temperature and a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a hydrogen bromide flow rate of from about 10 to 200 sccm;

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an oxygen flow rate of from about 1 to 50 sccm;

a nitrogen trifluoride flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

A4 cont

a magnetic field of up to about 200 gauss.

22. The method of claim 1, wherein the seasoned plasma reactor chamber cleaning step, when using an eight inch diameter substrate, employs:

a seasoned plasma reactor chamber pressure of from about 50 to 500mTorr;

a source radio frequency power of from about 100 to 200 watts at a source radio frequency of from about 2 to 13.56 MHz and a bias power of up to about 500 watts;

a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a nitrogen trifluoride or a sulfur hexafluoride flow rate of from about 10 to 500 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

a magnetic field of up to about 200 gauss.

Sub B4

23. The method of claim 7, wherein the dummy wafer seasoning methods include a method selected from the group consisting of:

i) a silicon oxide coated dummy wafer method;

ii) a silicon oxide coated dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas; and

A4 Cont

iii) a silicon dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas.

24. The method of claim 7, wherein the dummy wafer seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 1 to 500 mTorr;

a source radio frequency power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature and a dummy wafer temperature of from about 20 to 200°C;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

25. The method of claim 7, wherein the product wafer in-situ seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature and a product substrate temperature of from about 20 to 200°C;

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a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

26. The method of claim 7, wherein the waferless seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

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a plasma reactor chamber temperature of from about 20 to 200°C;

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a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

A4 Cont

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; 112

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

27. The method of claim 7, wherein the first silicon layer etch step, when using an eight inch diameter substrate, employs:

a reactor chamber pressure of from about 1 to 500 mTorr;

a radio frequency source power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz and an external bias power of up to about 500 watts;

a substrate temperature and a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a hydrogen bromide flow rate of from about 10 to 200 sccm;

an oxygen flow rate of from about 1 to 50 sccm;

a nitrogen trifluoride flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

a magnetic field of up to about 200 gauss.

28. The method of claim 7, wherein the seasoned plasma reactor chamber cleaning step, when using an eight inch diameter substrate, employs:

A4 cont

a seasoned plasma reactor chamber pressure of from about 50 to 500mTorr;

a source radio frequency power of from about 100 to 200 watts at a source radio frequency of from about 2 to 13.56 MHz and a bias power of up to about 500 watts;

a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a nitrogen trifluoride or a sulfur hexafluoride flow rate of from about 10 to 500 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

a magnetic field of up to about 200 gauss.

29. The method of claim 12, wherein the dummy wafer seasoning methods include a method selected from the group consisting of:

i) a silicon oxide coated dummy wafer method;

ii) a silicon oxide coated dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas; and

iii) a silicon dummy wafer method in conjunction with the seasoning plasma etch method additionally employing an oxygen containing etchant gas.

30. The method of claim 12, wherein the dummy wafer seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 1 to 500 mTorr;

a source radio frequency power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz;

A1 Cont

a plasma reactor chamber temperature and a dummy wafer temperature of from about 20 to 200°C;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

31. The method of claim 12, wherein the product wafer in-situ seasoning methods, when using an eight inch diameter substrate, employ:

a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature and a product substrate temperature of from about 20 to 200°C;

a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

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a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm;

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a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

Sub B4

32. The method of claim 12, wherein the waferless seasoning methods, when using an eight inch diameter substrate, employ:

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a plasma reactor chamber pressure of from about 50 to 1000 mTorr;

a source radio frequency power of from about 10 to 1000 watts at a source radio frequency of from about 2 to 13.56 MHz;

a plasma reactor chamber temperature of from about 20 to 200°C;

a silicon containing seasoning polymer layer forming gas flow rate of from about 1 to 200 sccm;

a bromine and/or chlorine containing etchant gas flow rate of from about 10 to 200 sccm;

an optional oxygen containing etchant gas flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; 112

a magnetic field of up to about 200 gauss; and

a plasma seasoning time of from about 5 to 120 seconds.

33. The method of claim 12, wherein the first silicon layer etch step, when using an eight inch diameter substrate, employs:

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a reactor chamber pressure of from about 1 to 500 mTorr;

a radio frequency source power of from about 10 to 2000 watts at a source radio frequency of from about 2 to 13.56 MHz and an external bias power of up to about 500 watts;

a substrate temperature and a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a hydrogen bromide flow rate of from about 10 to 200 sccm;

an oxygen flow rate of from about 1 to 50 sccm;

a nitrogen trifluoride flow rate of from about 1 to 50 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

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a magnetic field of up to about 200 gauss.

34. The method of claim 12, wherein the seasoned plasma reactor chamber cleaning step, when using an eight inch diameter substrate, employs:

a seasoned plasma reactor chamber pressure of from about 50 to 500mTorr;

a source radio frequency power of from about 100 to 200 watts at a source radio frequency of from about 2 to 13.56 MHz and a bias power of up to about 500 watts;

A4 Cont

a seasoned plasma reactor chamber temperature of from about 20 to 200°C;

a nitrogen trifluoride or a sulfur hexafluoride flow rate of from about 10 to 500 sccm;

a backside cooling gas pressure of from about 1 to 50 torr and a flow rate of from about 2 to 50 sccm; and

a magnetic field of up to about 200 gauss. --

Remarks

Examiner Goudreau is thanked for the thorough Office Action.

In the Claims

Claims 1, 7 and 12 have been amended to: improve readability and to thus overcome the 35 U.S.C. §112, second paragraph, rejection; and to incorporate the limitations of now cancelled claims 6, 11 and 16, respectively.